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ABSTRACT

Interaction and collaboration have been identified as desirable components of an effective learning environment; however, it is not clear from research how they improve the quality of learning in a distance education setting. While studies have addressed the types of technologies that impact on collaborative interactivity, little has been written about other drivers and their influence on ensuring successful student learning. The following drivers of collaborative interactivity are described: assessment; student characteristics; technology confidence and prior knowledge; role of the instructor; and interpersonal knowledge. A tentative model for conceptualizing these drivers is proposed. The model in the shape of a pyramid describes a progression of improved learning outcomes made possible by technology-mediated interaction. This paper examines whether such a model can support an investigation on effective collaborative interactivity resulting in successful student learning. A research program at the University of South Australia that will examine the impact of these drivers on various levels of interaction under the pyramid model is described. (Contains 34 references.) (MES)

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Abstract: Interaction and collaboration have been identified as desirable components of an effective learning environment, however it is not clear from research how they improve the quality of learning in a distance education setting. While studies have addressed the types of technologies that impact on collaborative interactivity, little has been written about other drivers and their influence on ensuring successful student learning. A tentative model for conceptualizing these drivers has been proposed. The model in the shape of a pyramid attempts to describe a progression of improved learning outcomes made possible by "technology-mediated interaction". This paper aims to provoke discussion as to whether such a model can support an investigation on effective collaborative interactivity resulting in "successful" student learning.

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Introduction

New technologies, changing demands for greater flexibility and increased access, as well as marketing considerations have led universities and other organisations to offer Internet-based courses. Research has already provided adequate evidence of the Internet's ability to meet these needs and provide an effective learning environment in a distance education setting (Vargo, 1997; Owston, 1997). As technology continues to have a profound effect on colleges and universities around the world, technology must not become the focus of education, but must be seen as a tool for enhancing the learning and teaching process at a distance. The focus must be to ensure quality learning outcomes using effective instructional strategies and appropriate technologies. What then are the factors that influence an effective teaching and learning environment?

The idea of the teaching-learning process as a sort of conversation is hardly a new idea where deep approaches to learning are encouraged through dialogue, structured goals and activity (Ramsden, 1992). Computer technologies, which have evolved over the past 15 years, have enabled students to interact with the content, program interface, the instructor, and other students, both individually and in groups. Research by Berge (1999) and King & Doerfert (1996) have identified interaction as one of the essential issues in computer-based distance education. The term, interaction, almost seems to elude definition. An attempt to define the word has led to clarification in terms of types and levels of interaction in a computer-based environment. Interactivity necessitates control by the learner and requires a response to a person or object where the quality and amount will determine its effectiveness. Frequently off-campus classes suffer from the loss of the learning community and social relationships. Using collaborative learning approaches can enable Internet-based learning to be as effective as the traditional classroom where collaborative learning is a common feature (Hiltz, 1998; Hughes & Lindsay, 1998). Inherent in collaboration is interactivity. Hoyles, Healy, & Pozzi (1994) report that powerful interactions between students can lead to higher order thinking, hypothesis formation and reflection. Collaborative interactivity, which is a combination of collaboration over learning tasks and rich discursive interaction, is therefore seen as an essential component for providing a richer learning experience.

Research by Hiltz (1998) and King & Doerfert (1996) clearly points to the value of interactivity and collaboration in any learning community, but what are the drivers that stimulate such activity in an Internet-based environment where place and time are no longer tightly prescribed? The term, driver is not regularly used in the research literature, but has been chosen because of the sense of force, control and impact that it conveys, and its underlying influence on the pedagogy, design, and development of courses. Some of these drivers have been addressed in a number of studies (Hiltz, 1998; Gilbert & Moore, 1998), but the aggregation of drivers and how they interact is yet to be investigated. What drivers are significant and in what context? Are there drivers that form the foundation for successful student learning?

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The following drivers are hypothesized as impacting on the effectiveness of collaborative interactivity, which in turn affect the quality of the learning outcomes. They include assessment, student characteristics, student's prior knowledge, interpersonal knowledge, available technologies, and instructor management. This paper will provide a tentative model for conceptualizing these drivers. In this model features that support the development of collaborative interactivity will be examined. This paper will analyse the drivers that foster collaborative interactivity, and how they impact on student learning. The proposed investigation of how drivers influence collaborative interactivity will inform the higher education sector on practices that lead to quality learning outcomes and assist in the development of Internet-based courses.

Review of Relevant Literature

Colleges, universities and business organisations are forging ahead in providing learning opportunities at a distance, made possible by the rapid advancement of Internet technologies. It should be noted that "The WWW does not guarantee learning any more than the presence of a library on campus guarantees learning" (Reeves,1999). The Web is a resource which must be designed to support effective instructional dimensions (Reeves, 1997). It is a medium that can provide a pedagogically sound foundation, conducive to active learning, construction of knowledge and discursive interactivity. The Internet has the potential to support a community of learners in an emerging global society. Kitchen & McDougall, (1999) in their meta-analysis of studies across grade levels on collaborative learning strategies indicate benefits in "student academic achievement, intergroup relations, diversity awareness, individual self-esteem and high level thinking".

Theoretical framework

Johnson & Johnson (1996) have provided a strong theoretical basis for collaborative learning as outlined in cognitive developmental, behavioral and social interdependence theories. Although most of the strong theoretical basis has been derived from face to face studies such theories are beginning to find support in the Internet-based environment. In order to address the underlying theoretical basis we need to understand how students learn in this environment. Learning is a process whereby knowledge is constructed and transformed into new and meaningful information. Research has found that cooperative learning increases elaboration as well as higher-order thinking, metacognitive processes, and divergent thinking (Susman, 1998). Vygotsky adds support to the value of interaction and cooperation through his premise "that knowledge is social, constructed from cooperative (in Johnson & Johnson, 1996). Students learn best by interacting with others, rather than working in isolation. Wittrocks' generative learning theory (in Susman, 1998) also attempts to add support by explaining why people learn best together. The resultant interactivity leads to knowledge-building which requires "articulation, expression or representation of what is learned" (Jonassen Peck & Wilson, 1999). Such thinking is aligned with current conceptions of constructivist learning.

Constructivism, which is derived from branches of cognitive science, emphasises the importance of learners creating, developing and constructing their ideas. Out of the notion of discovery and exploration has evolved research on interactive and collaborative learning around meaningful activities. Through such collaborative efforts learners are able to reflect and elaborate on their ideas as well those of their peers. Jonassen, Peck & Wilson (1999) identify the following attributes as indicators of meaningful learning: active, constructive, intentional, authentic and cooperative. They further depict these characteristics as being interrelated, interdependent and interactive. Of particular interest is the interactivity that leads to collaboration.

Frequently in the literature, collaboration and cooperation have been used interchangeably. For the purposes of this study, the two terms will be contrasted. Collaboration can be viewed as one element of a continuum. At one extreme, learning occurs in a competitive environment, in which students realise that their final grades depend upon their performance judged relative to the performance of their peers. This situation is described as competitive. Where criterion-based performance measures are established, and where students are expected to demonstrate their own capabilities without input or feedback from others, we see individualistic instruction. In a more student-centred environment, that recognizes the value of input and feedback from others, learning becomes more cooperative. Cooperation can require students to work on an agreed common task where the end product is a combination of the individual efforts. Collaboration goes a step further. Individual tasks may be distributed according to abilities, but the end product requires a merging of the individual efforts resulting in the culmination and achievement of a common and explicit goal through constant interaction. The interactive nature of the computer lends support to elaboration and engagement, which are crucial components of collaborative interactivity.

Behaviorists, such as Skinner and Homans, also give some support to collaborative interactivity in their recognition of group reinforcers and rewards for learning. The social interdependence theory has found that positive interdependence encourages interaction where individuals work together, promoting each others' successes towards a common goal.

Types of Interaction

Although Interaction has already been identified as an important ingredient in an Internet-based learning environment, there appears to be little consensus on what interactivity actually involves or represents. Moore (1993) identified three types of interaction. Learner-content interaction explains the learner's involvement with the content as they construct their knowledge by building on the information given. Learner-learner interaction is either a one to one exchange or communication with a small or large group. Learner-instructor interaction is the communication between the learner and the instructor for the purpose of explaining, elaborating, scaffolding and providing feedback. Hillman, Willis & Gunawardena (1994) add a fourth type of interaction, learner-interface interaction. This type of interaction explains the relationship between the learner and the technology that is used to access the material.

Another view on interactivity is provided by Paulsen (1995), who discusses interaction in terms of a pedagogical technique based on the four communication paradigms. One-alone communication refers to engagement with the learning resources, which may include online databases, learning activities, and web resources. One-one communication is between two people accommodated by email or one-one chats. One-many communication is supported through discussion lists, bulletin boards online chats and symposiums. Many-many communications can be organized within computer conferencing systems and can include debates, role plays, brainstorming as a few examples.

Levels of interactivity

There have been a number of attempts to prescribe rubrics of interaction. Jonassen (1988) identified five levels of interactivity in terms of the user's involvement and how it might impact on learning outcomes. The levels included the modality of the learner's response, the nature of the task, the level of processing, the type of program and the level of intelligence in design. Schwier & Misanchuk (1993) detail a taxonomy of interactivity based on three dimensions: levels, functions and transactions. Spector (in Sims, 1997) suggests that the learner's mental engagement or involvement with the content impact on the level of interaction rather than the conversational interfaces. From the research it is clear that interactivity is highly desirable but do these analyses carry over to an Internet-based learning environment? The challenge must be to develop a model for understanding the complexities of the relationship between "technology-mediated interaction" and learning outcomes.

A Model of Technology-Mediated Interaction

The following model has been developed in order to explain the relationship between the various types of interaction and the suitability of various technologies to support the interaction. It also attempts to describe a progression in the levels of interaction that show a shift from surface to deep learning (Ramsden, 1992). The model is portrayed in the shape of a pyramid with a series of levels building on from each other and leading to collaboration at the apex. In this model it is assumed that adequate instruction on the use of the various technologies has been given and ongoing technical support is available. Confidence and comfort with the medium is an essential ingredient for an effective Internet-based environment. The assumption is, the higher the level, the greater the quality and amount of interaction that will occur and the more desirable the learning outcomes will be.

The base of the model comprises synchronous chat or email in a predominantly one to one exchange where group size is of little significance. There is a view that students are more likely to become actively engaged if they feel comfortable with other learners through the exchange of interpersonal knowledge in chat or email. As we move up the pyramid, we analyze the purpose and function of various levels of discussion ranging from open, unmoderated and general, through to closed, tightly focused and restricted small groups. The subtleties and specifications of these forms of discussion provide opportunity for varied levels of interaction and engagement leading to desirable and more complex learning outcomes. The model suggests hypothesised learning outcomes that may be evident at the various levels of discussion.

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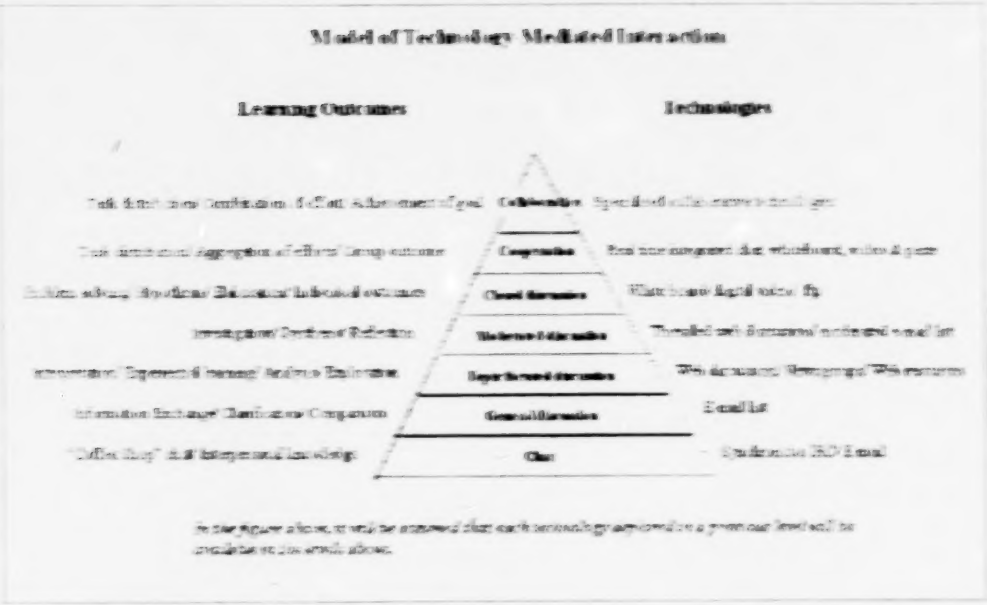

The pyramid attempts to describe a progression to improved learning outcomes made possible by "technology-mediated interaction". As engagement and elaboration increases, support and scaffolding of the peer relationship emerge which support a cooperative and eventually a collaborative community of learners. The overall course context and instructional design will determine how the various drivers impact on both the quality of learning and the progression up the pyramid. The model offers a way in which we can conceive and conceptualise questions like this: How can we actively engage students in the learning process? What drivers can be identified as impacting on the upward progression?

Drivers of Collaborative Interactivity

Assessment

Assessment has been identified as a key motivator of learning. Students tend to learn what they know will be assessed. If participation in Internet-based discussion lists is not required or assessed, the lists tend to be used very little, and only by the more conscientious student (Hiltz, 1997). Dow & Geer (1996) found in their study of an undergraduate teacher education subject that although participation in electronic tutorial discussions was obligatory there was little interactivity and little reflection, because the responses were not assessed. Other course developers have found that unless interaction is closely integrated into the overall course requirements, limited discussion will take place. Marttunen (1998) in the investigation of student's email as a medium for practicing academic argumentation found that the majority of messages were non interactive in nature and that real interaction was very rare. Conversely, Hartley & Collins-Brown (1999) raise the issue that if students feel forced or pressured to collaborate, how can a spirit of collaboration be infused amongst students? Interaction and collaboration will happen if it is a requirement, but will quality learning outcomes be achieved unless closely tied to assessment?

Student Characteristics

As well as being influenced by assessment, student characteristics impact on the intensity and frequency of interactivity. They are also a major factor in the achievement and satisfaction levels of the distant learner (Phipps & Merisotis, 1999). Student's prior knowledge of the subject content and their expectations may lead either to problems of passivity or dominance in Internet-based discussions. Student's literacy has been identified as a limitation in text-based discussion mediums, where participation is limited to those who are literate and are able to express themselves through competencies in language and rhetoric (Ryder & Wilson, 1995; Kearsley, 1997).

There are also problems associated with participants who are relegated to passive roles in society, but who are suddenly given empowerment to express their thoughts. However, for students who lack confidence in their verbal skills, the asynchronous learning environment allows them time to reflect and formulate their response. Freedman & Liu (1996) in their study on multicultural networking found that students from different ethnic backgrounds had "different attitudes about and knowledge of computers, cross-cultural communication patterns and learning processes when working with computers". How important is group composition or general student characteristics in ensuring quality learning outcomes through collaborative interactivity?

Technology Confidence and Prior Knowledge

Knowledge of student's preferred learning style and prior knowledge will influence the course design and the type of technology used. Student's confidence with the technology as well as accessibility will further impact on successful interaction. Adequate training in the technologies as well as constant technological support during the duration of the course is essential. The transparency of the technologies and their integration into the instructional design impact on students' comfort and their ability to utilize them for interaction. The technology is adequately able to support the pedagogical shift from teacher-centred to learner-centred and from competitive to collaborative. As the bandwidth increases and even newer technologies emerge, collaborative interactivity in an Internet-based environment will closely emulate the on-campus classroom. Previously interaction occurred mainly between the learner and the instructor. Today's technologies encourage learners to interact with each other, thus changing the role of the online instructor.

Role of the Instructor

The role of the instructor in courses reliant on "technology-mediated interaction" is evolving as the technologies evolve. Instructor engagement should be seen as a critical driver of the quality of learning outcomes and movement up the pyramid. Mason (1991) outlines specific roles for online instructors, which include organisational, social and intellectual. At the same time he notes that excellence in online moderation is similar to other forms of teaching where enthusiasm and involvement, intellectual perception, insight, and scaffolding for the learner are essential ingredients. Berge (1996) preferred to categorize the role of the instructor into four areas: pedagogical, social, managerial and technical. He proposed that instructors must also be comfortable and proficient with the technology to ensure that the learners are comfortable. A successful facilitator knows how "to integrate life experience, communication, professionalism and content into the learning environment"(Illinois Online Network, 1998). Does the instructor influence the level of interactivity at which students engage and how does the involvement change at the various pyramid levels?

Interpersonal Knowledge

Johnson & Johnson (1996) have identified an extension of social interdependence theory that focuses on relationships among diverse individuals. Recent literature (Jonassen et al., 1999; Hughes & Lindsay, 1998) has begun to show the significance of social interaction on learning outcomes. Bauman (nd) identifies the affect of social factors as being significantly powerful and motivating to keep students in school. Interpersonal exchanges in Internet-based environments have the potential to alleviate some of the misunderstandings and misinterpretations that may occur due to the lack of social cues and face to face interaction. Such exchanges can assist facilitators with their instructional design in meeting the learning needs of their diverse student population. They can also help students overcome some of their reticence in sharing their views with unknown persons. The social community that is created during the learning process can impact on the nature of the learning activities and the learning outcomes (McLoughlin, 1999). Instructors are recognising the value of providing opportunities for interpersonal exchanges. Hughes & Lindsay (1998) and Hiltz (1998) recognise the value of informal socializing and have created the notion of a "Coffee Shop". In attempting to increase student comfort, it is important that prejudices such as a person's age, gender, nationality, economic status and disabilities are not unmasked within the Internet-based environment. The potential for equality is one of the strengths of Internet-based environments. Does informal socializing in an Internet-based environment increase the potential for collaborative interactivity?

Research in Internet-based subjects at the University of South Australia

A research program at the University of South Australia will examine the impact of these drivers on various levels of interaction under the pyramid model. The subjects will be students enrolled in undergraduate, graduate and post graduate subjects, which use open learning technologies. In order to generalise findings across

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disciplines and levels, national and international parallel subjects will also be targeted. Research, using both quantitative and qualitative approaches through the use of survey questionnaires and discourse analysis, will be used to address questions relating to driver impact on learning outcomes.
An important outcome of this research should be better teaching practice leading to successful student learning, and that in the end, is what all educational research must be about.

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